

I Claim:

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5 1. An adsorbent catalyst for reducing amounts of nitrogen oxides, hydrocarbons and carbon monoxide contained in exhaust or combustion gases, wherein the catalyst adsorbs nitrogen oxides when the exhaust or combustion gases contain an excess of oxygen, and liberates and reduces the adsorbed nitrogen oxides when said gases contain oxygen in stoichiometric amounts or less, the adsorbent catalyst comprising: a porous support material, at least the surface area of which contains at least one of the following:

a first catalytic metal,

a first NO_x adsorbent, which contains at least one of the following metals: Ba and Sr,

a second NO_x adsorbent, which contains at least one of the following metals: La and Y, and

a redox NO_x adsorbent, which contains at least one of the following metals: Ce, Zr, Ti, Nb, Mn, Pr, Nd, Sm, Eu and Gd.

2. An adsorbent catalyst according to claim 1, further comprising a second catalytic metal, which comprises at least one of the following metals: Rh, Pd and Ir.

3. An adsorbent catalyst according to claim 1, further comprising a third NO_x adsorbent, which contains at least one of the following metals: K, Na, Li, Ca, Rb and Cs.

4. An adsorbent catalyst according to claim 1, further comprising a fourth NO_x adsorbent, which contains at least one of the following metals: Mg and Be.

5. An adsorbent catalyst according to claim 1, wherein the adsorbents are in the form of oxides, sulfates, nitrates, aluminates or metals.

6. An adsorbent catalyst according to claim 1, wherein the redox NO_x adsorbent contains at least one of Ce and Zr.

7. An adsorbent catalyst according to claim 6, wherein the redox NO_x adsorbent is a mixed oxide of ZrCe, MnCeZr or MnCe.

8. An adsorbent catalyst according to claim 1, comprising a first surface, on which there is a first coating which contains the support material and at least a portion of said adsorbents, and a second surface, on which there is a second coating which contains the support material and at least a portion of said adsorbents or a part of them.

9. An adsorbent catalyst according to claim 8, wherein the first surface is formed by an essentially smooth metal foil, and the second surface is formed by a corrugated metal foil, the foils forming a honeycomb comprising numerous flow channels for gas.

10. An adsorbent catalyst according to claim 8, wherein the first catalytic metal is Pt and is present in both coatings, and the second catalytic metal is present only in one coating.

11. An adsorbent catalyst according to claim 9, wherein the first catalytic metal is divided concentration-wise between the foils such that in one foil the Pt load is 0-90 g/ft³ and

in the other foil the Pt load is 70-400 g/ft³, whereby volume refers to the volume of the honeycomb formed from the foils.

12. An adsorbent catalyst according to claim 9, wherein the first NO_x adsorbent is divided concentration-wise between the foils such that in the support material of one foil the concentration is 8-40% by weight, and in the support material of the other foil the concentration is 0-10% by weight, preferably 3-8% by weight, wherein the weight % concentrations have been calculated as oxides in relation to the weight of the support material.

13. An adsorbent catalyst according to claim 9, wherein the second NO_x adsorbent is divided concentration-wise between the foils such that in the support material of one foil the concentration is 8-40% by weight, and in the support material of the other foil the concentration is 0-8% by weight, wherein the weight % concentrations have been calculated as oxides in relation to the weight of the support material.

14. An adsorbent catalyst according to claim 9, wherein the redox adsorbent is divided concentration-wise between various foils such that in the support material of one foil the concentration is 10-60% by weight, and in the support material of the other foil the concentration is 0-10% by weight, wherein the weight % concentrations have been calculated as oxides in relation to the weight of the support material.

15. An adsorbent catalyst according to claim 9, wherein the adsorbents are wholly in the support material of one foil, and the catalytic metals are wholly in the support material of the other foil, which is preferably the corrugated foil.

16. An adsorbent catalyst according to claim 1, wherein the support material contains mainly at least one of the following oxides: aluminum oxide, zeolite, aluminium silicate and silica.

17. A catalyst system for reducing the amounts of nitrogen oxides, hydrocarbons and carbon monoxide contained in exhaust or combustion gases, comprising the adsorbent catalyst according to claim 1, and a second catalyst positioned, with respect to the direction of the gas flow, in front of the adsorbent catalyst.

18. A catalyst system according to claim 17, wherein the said second catalyst contains a catalytic metal which comprises at least one of the following metals: Pd, Rh and Pt.

19. An adsorbent catalyst according to claim 5, wherein the adsorbents are in the form of oxides.

20. An adsorbent catalyst according to claim 8, wherein the first and second coatings each have a composition which are substantially identical.

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21. An adsorbent catalyst according to claim 8, wherein the first and second coatings each have a composition which are substantially identical which differ from each other.

22. An adsorbent catalyst according to claim 12, wherein the concentration of the first NO_x adsorbent in one foil is 10-20% by weight, and the concentration in the other foil is 3-8% by weight.

23. An adsorbent catalyst according to claim 13, wherein the concentration of the second NO_x adsorbent in one foil is 5-15% by weight, and the concentration in the other foil is 1-6% by weight.

24. An adsorbent catalyst according to claim 14, wherein the concentration of the redox adsorbent in one foil is 15-25% by weight, and the concentration in the other foil is 15-25% by weight, and the concentration in the other foil is 2-5% by weight.

25. An adsorbent catalyst according to claim 15, wherein the adsorbents are wholly in the smooth foil, and the catalytic metals are wholly in the corrugated foil.

26. A method for reducing the amounts of nitrogen oxides, hydrocarbons and carbon monoxide contained in exhaust or combustion gases, the method comprising introducing the gasses to be purified to the adsorbent catalyst of claim 1, whereby the adsorbent catalyst adsorbs nitrogen oxides when the exhaust or combustion gases contain an

excess of oxygen, and liberates and reduces the adsorbed nitrogen oxides when said gases contain oxygen in stoichiometric amounts or less.

27. A method according to claim 26, the method further comprising using short guided or natural periods, where gases contain a stoichiometric amount of oxygen or less.

28. A method comprising: adsorbing an ingredient in a medium onto an adsorbent catalyst and reacting it catalytically with a reactant to produce a desired compound, wherein the adsorbent catalyst contains one or more catalytic metals as well as one or more adsorbents, and continuous functioning of adsorption and the catalyzed reaction are realized under heterogenous conditions.

29. A method according to claim 28, wherein the heterogenous conditions are provided by proceeding in relation to a reaction on one side of the stoichiometric ratio in the adsorption phase and on the other side thereof in the catalyzed phase.

30. A method according to claim 21, wherein the heterogenous conditions are provided with changes in temperature or pressure.

31. A method according to claim 28, wherein:
the medium is a gaseous medium;
the ingredient is nitrogen oxide, a hydrocarbon, carbon monoxide and/or an oxide of sulfur;

the reactant is carbon monoxide, hydrogen gas, a hydrocarbon, and/or gaseous oxygen; and the product is nitrogen gas, carbon dioxide, water, sulfur dioxide and/or hydrogen sulfide.

32. A method according to any of claim 21, wherein the reactant is periodically brought to the adsorbent catalyst.

33. A method according to any of claim 21, wherein the adsorbent catalyst is formed of an essentially smooth metal foil and of a corrugated metal foil, whereby one of the foils contains adsorbents and the other contains catalytic metal.

34. A method for reducing the amounts of nitrogen oxides, hydrocarbons and carbon monoxides contained in exhaust or combustion gasses, the method comprising, passing the gases through the catalytic system of claim 17, whereby the adsorbent catalyst adsorbs nitrogen oxides when the exhaust or combustion gases contain an excess of oxygen, and liberates and reduces the adsorbed nitrogen oxides when said gases contain oxygen in stoichiometric amounts or less.

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